REMARKS

Reconsideration of the above-identified application in view of the present amendment is respectfully requested.

The present amendment cancels claims 11-19, 21-32, and 34. The present amendment also deletes the following language from claims 33 and 42:

> "said metal powder including macro-agglomerates of metal particles, said metal particles having an average diameter less than about 0.1 µm and having an oxide layer that prevents contact of said particles with said oxidizer."

The amendment to claims 33 and 42, as discussed hereinafter, attempts to overcome the 35 U.S.C.§112, first paragraph and second paragraph rejections in items 1-3 of the present Office Action. Thus, the present amendment merely reduces the number of issues for appeal by reducing the number of claims to be appealed and overcoming the 35 U.S.C. §112, first paragraph and second paragraph rejections. Moreover, the subject matter of amended claims 33 and 42 was under consideration prior to the final action. Therefore, a showing under 37 C.F.R. §1.116(b) is not believed to be needed and entry of the amendment is respectfully requested.

Below is a discussion of the 35 U.S.C. §112 first paragraph rejection and second paragraph rejection as well as a discussion of the 35 U.S.C.§103(a) rejection.

1. **35 U.S.C.§112 first paragraph rejection of claims 11-19 and 21-44.**

Claims 11-19 and 21-44 were rejected under 35 U.S.C. §112, first paragraph, as containing subject matter that was not described in the patent application in such a way to

reasonably convey to one skilled in the art that the inventor had possession of the claimed invention.

The Office Action states that there only appears to be one disclosed mode of practicing the invention, which is to use electro-exploded powder, and therefore the claims are not adequately described.

As noted above, claims 11-19, 21-32 and 34 were cancelled. These claims were directed to an electrically actuatable igniter that includes an electro-exploded metal powder. The limitations of claims 33 and 42, which were directed to the physical characteristics of the composition of the electro-exploded metal powder, have been deleted. Thus, the remaining claims, i.e., claims 33 and 35-44 are directed to an electrically actuatable igniter that includes an electro-exploded metal powder.

The term electro-exploded metal powder is clearly supported in the written description of the application. Pages 8 and 9 teach how an electro-exploded metal powder is formed. Page 10 also discloses that electro-exploded metal powders in accordance with the present invention are commercially available from Argonide Co. Thus, the disclosure of the present application clearly allows persons of ordinary skill in the art to recognize what is claimed.

The additional language that was deleted from the claims 33 and 42 was merely a physical description of the electro-exploded metal powder. These limitations were an inherent feature of the electro-exploded metal powder. These limitations, however, have now been deleted because the Office

Action considered these limitations to be confusing. Thus, withdrawal of the 35 U.S.C. §112, first paragraph, rejection of claim 1 is respectfully requested.

2. **35 U.S.C. §112, second paragraph, rejection of claims 11-19 and 21-44.**

Claims 11-19 and 21-44 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for fail to particularly point out and distinctly claim the subject matter that the applicant regards as the invention.

The Office Action states that the present invention contains two distinct sets of claims. As discussed above, claims 11-19, 21-32, and 34 have been deleted. Additionally, claims 33 and 42 have been amended to delete the subject matter that pertains to a physical description of the electro-exploded metal powder. Accordingly, the Office Action's arguments with respect to this point are moot.

The Office Action also requests that the applicant state on the record whether the electro-exploded powder has only fines, agglomerates, or both. The applicant affirmatively states that the electro-exploded metal powder comprises both a mixture of fines and agglomerates.

Thus, withdrawal of the 35 U.S.C. §112, second paragraph, rejection of claim 33 is respectfully requested.

3. **35 U.S.C. §103(a) rejection of claims 11-19 and 21-44.**

Claims 11-19 and 21-44 were rejected under 35 U.S.C. 103(a) as being unpatentable o-er Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom.

As noted above, claims 11-19, 21-32, and 34 have been cancelled. Claim 33 was amended so that claim 33 recites an electrically actuatable igniter that comprises a pair of electrodes, a heating element electrically connected between said electrodes, and an ignition material in contact with said heating element. The ignition material comprises a mixture of a metal powder and a particulate oxidizer that exothermically reacts with the metal powder. The oxidizer has an average particle size of about 1 μm to about 30 μm. The metal powder is selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder. The ignition material deflagrates when the heating element is heated to a temperature of at least about 250°C.

Claim 33 is patentable over Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom because: (1) Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated to a temperature of at least about 250°C and that includes a metal powder which is selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder, and an oxidizer which has an average particle size of about 1 μm to about 30 μm; and (2) it would not have been

obvious to use the electro-exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al.

Baginski, as noted in the Office Action, teaches the basic invention of explosive primers with a pyrotechnic mix around a bridgewire. The pyrotechnic compound can include zirconium and potassium perchlorate, or alternatively other pyrotechnic compounds, such as titanium hydride potassium perchlorate and boron potassium nitrate.

Baginski does not teach an ignition material that includes a metal powder selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder. Baginski also does not teach using an oxidizer that has an average particle size of about 1 μm to about 30 μm.

Halcomb et al. teach a thermite composition that uses a finely divide aluminum powder and a metal oxide such as iron oxide, copper oxide, tungsten oxide, or chromium oxide.

Halcomb et al. do not teach an ignition material that includes a metal powder selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder. Halcomb et al. also do not teach using an oxidizer that has an average particle size of about 1 μm to about 30 μm.

Dixon et al. teach a lead free combustion primer that includes a metastable interstitial composite. The metastable interstitial composite includes aluminum and molybdenum trioxide having a particle size of about 0.1 μm or less.

Dixon et al. do not teach a metal powder selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder. Dixon et al. only disclose that the aluminum particles have a particle size of less than 0.1 μm not that they are formed by electro-explosion. As noted above and in the specification, electro-exploded metals form nano-sized particles that agglomerate into micron-sized powders. Dixon et al. neither disclose nor suggest that the aluminum particles in Dixon et al. have this feature. Dixon et al. only discloses that the particles form metastable interstitial composites.

Moreover, Dixon et al. state that the particle size of the oxidizer (i.e., MoO_3) is preferably less than 0.1 μm. Whereas, in the invention recited in claim 1, the oxidizer has a particle size of about 1 μm to about 30 μm.

Wheatley teaches a gas generating composition that includes an ammonium nitrate or a strontium nitrate based oxidizer mixture. (Column 2, lines 21-23). The gas generating composition also includes exploded aluminum powder. The exploded aluminum powder is used as a combustion modifying additive to increase the burning rate and lower the pressure

exponent of the ammonium nitrate or strontium nitrate gas generating composition. (Column 3, lines 31-35).

Wheatley does not teach that the oxidizer has an average particle size of about 1 μm to about 30 μm. Moreover, it would not have been obvious to use the electro-exploded powder taught in Wheatley in the ignition compositions taught in Baginski and Halcomb et al. Wheatley teaches using exploded aluminum as an additive to an ammonium nitrate based gas generating composition to lower the pressure exponent and increase the burning rate of the ammonium nitrate gas generating composition. The ignition compositions taught in Baginski and Halcomb et al., however, do not include ammonium nitrate and would therefore not have a high pressure exponent and a low burning rate, which is caused by ammonium nitrate. Hence, there would be no reason to add electro-exploded aluminum to the ignition compositions of Baginski and Halcomb et al.

The Office Action suggests that one using the electro-exploded aluminum in a similar pyrotechnic composition would expect similar results, and therefor its substitution would have been obvious. The pyrotechnic compositions taught in Baginski and Halcomb et al. are not similar pyrotechnic compositions to the gas generating composition taught in Wheatley. The pyrotechnic compositions taught in Baginski and Halcomb et al. are primary ignition composition that use a metal as the primary fuel in combination with an oxidizer. The composition of Wheatley, in contrast, is a gas generating composition that includes an organic fuel, an oxidizer, and a

metal additive. It is mere speculation, at best, whether the addition of a metal additive, which is used to increase the burning rate and lower the pressure exponent of a gas generating composition, would also increase the burning rate and lower the pressure exponent of an ignition composition. Further, there is nothing in the prior art that suggests that that the addition of electro-exploded aluminum to a pyrotechnic composition would even be desirable.

Lundstrom teaches a chlorate free auto-ignition composition that includes an azodiformamidine dinitrate, an oxidizer, and an accelerator. The accelerator used in conjunction with the azodiformamidine dinitrate preferably includes a fine iron oxide powder, which has an average particle size of about 3 nm.

Lundstrom does not teach an ignition material that includes a metal powder selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder. Lundstrom also does not teach using an oxidizer that has an average particle size of about 1 μm to about 30 μm.

Thus, claim 33 is not obvious over Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom. Therefore, allowance of claim 33 is respectfully requested.

Claim 35 depends from claim 33 and further recites that the oxidizer is selected from the group consisting of alkali metal nitrates, alkaline earth metal nitrates, alkali metal perchlorates, alkaline earth metal perchlorates, alkali metal

chlorates, alkaline earth metal chlorates, ammonium perchlorates, ammonium nitrate, and mixtures thereof.

As noted above with respect to claim 33, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated to a temperature of at least about 250°C and that includes a metal powder, which is electro-exploded aluminum, and an oxidizer, which has an average particle size of about 1 μm to about 30 μm; and (2) it would not have been obvious to use the electro-exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al. Therefore, claim 34 is allowable for the same reasons as claim 33 and for the specific limitations recited with respect to claim 34.

Claim 36 depends from claim 33 and further recites that the electro-exploded metal powder is electro-exploded aluminum.

As noted above with respect to claim 36, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated to a temperature of at least about 250°C and that includes a metal powder, which is electro-exploded aluminum, and an oxidizer, which has an average particle size of about 1 μm to about 30 μm; and (2) it would not have been obvious to use the electro-exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al. Therefore, claim

36 is allowable for the same reasons as claim 33 and for the specific limitations recited with respect to claim 36.

Claim 37 depends from claim 33 and further recites that the elctro-exploded metal powder is about 15% to about 75% by weight of the ignition material.

As noted above with respect to claim 33, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated to a temperature of at least about 250°C and that includes a metal powder, which is selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder, and an oxidizer, which has an average particle size of about 1 μm to about 30 μm; and (2) it would not have been obvious to use the electro-exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al. Therefore, claim 37 is allowable for the same reasons as claim 33 and for the specific limitations recited with respect to claim 37.

Claim 38 depends from claim 33 and further recites that the amount of oxidizer is about 25% to about 85% by weight of the ignition material.

As noted above with respect to claim 33, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated

to a temperature of at least about 250°C and that includes a metal powder, which is selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder, and an oxidizer, which has an average particle size of about 1 μm to about 30 μm; and (2) it would not have been obvious to use the electro-exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al. Therefore, claim 38 is allowable for the same reasons as claim 33 and for the specific limitations recited with respect to claim 38.

Claim 39 depends from claim 33 and further recites that the ignition material upon deflagration produces an ignition product with a temperature of about 3000°C to about 6000°C.

As noted above with respect to claim 33, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated to a temperature of at least about 250°C and that includes a metal powder, which is selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder, and an oxidizer, which has an average particle size of about 1 μm to about 30 μm; and (2) it would not have been obvious to use the electro-exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al.

Moreover, none of the references disclose or suggests an ignition material, which upon deflagration, produces an ignition product with a temperature of about 3000°C to about 6000°C. The only reference that discloses a temperature, is Wheatley. Wheatley, however, teaches that the combustion temperature is below 2300K.

Therefore, claim 39 is allowable for the same reasons as claim 33 and for the specific limitations recited with respect to claim 39.

Claim 40 depends from claim 33 and further recites that the ignition material does not thermally decompose at temperatures up to about 120°C.

As noted above with respect to claim 33, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated to a temperature of at least about 250°C and that includes a metal powder, which is selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder, and an oxidizer, which has an average particle size of about 1 μm to about 30 μm; and (2) it would not have been obvious to use the electro-exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al. Therefore, claim 40 is allowable for the same reasons as claim 1 and for the specific limitations recited with respect to claim 40.

Claim 41 depends from claim 1 and further recites that the metal powder has a surface area of about 15 square meters per gram.

As noted above with respect to claim 41, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated to a temperature of at least about 250°C and that includes a metal powder, which is selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder, and an oxidizer, which has an average particle size of about 1 μm to about 30 μm; and (2) it would not have been obvious to use the electro-exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al. Therefore, claim 41 is allowable for the same reasons as claim 33 and for the specific limitations recited with respect to claim 41.

Claim 42 recites an electrically actuatable igniter that comprises a pair of electrodes, a heating element electrically connected between the electrodes, and an ignition material in contact with the heating element. The ignition material comprises about 25% to about 50%, by weight of the ignition material, a metal powder and a particulate oxidizer that exothermically reacts with the metal powder. The oxidizer has an average particle size of about 1 μm to about 30 μm. The metal powder consists of electro-exploded aluminum powder and

the ignition material deflagrates when the heating element is heated to a temperature of at least about 250°C.

Claim 42 contains limitations, which are similar, to the limitations recited in claim 33. As noted above with respect to claim 33, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated to a temperature of at least about 250°C and that includes a metal powder, which is selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder, and an oxidizer, which has an average particle size of about 1 µm to about 30 µm; and (2) it would not have been obvious to use the electro-exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al.

Moreover, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose that the metal powder comprises about 25% to about 50% by weight of the ignition material and the oxidizer comprises about 50% to about 75% by weight of the ignition material.

Baginski and Halcomb et al. do not teach the percentages of the metal fuel and the oxidizer in each of their respective ignition compositions. Dixon et al. teach aluminum at a percentage of 45% and MoO_3 at a percentage of 55%; however, Dixon et al. do not teach that the aluminum is electro-

exploded or that the MoO_3 has a particle size of about 1 μm to about 30 μm. Wheatley teach adding electro-exploded aluminum to a gas generating composition, but only in a weight percentage of up to 20% by weight of the gas generating material. Likewise, Lundstrom teach adding super fine iron oxide to a gas generating composition, but only in an amount of up to about 10%.

Therefore, claim 42 is patentable over the Baginski in view of Halcomb et al. Dixon et al., Wheatley, and Lundstrom and allowance of claim 42 is respectfully requested.

Claim 43 depends from claim 42 and further recites that the oxidizer is selected from the group consisting of alkali metal nitrates, alkaline earth metal nitrates, alkali metal perchlorate, alkaline earth metal perchlorates, alkali metal chlorates, alkaline earth metal chlorates, ammonium perchlorate, ammonium nitrate, and mixtures thereof.

As noted above with respect to claim 42, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated to a temperature of at least about 250°C and that includes a metal powder, which is selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder, and an oxidizer, which has an average particle size of about 1 μm to about 30 μm; and (2) it would not have been obvious to use the electro-

exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al. Therefore, claim 43 is allowable for the same reasons as claim 42 and for the specific limitations recited in claim 43.

Claim 44 depends from claim 42 and further recites that the ignition material upon deflagration produces an ignition product with a temperature of about 3000°C to about 6000°C.

As noted above with respect to claim 42, Baginski in view of Halcomb et al., Dixon et al., Wheatley, and Lundstrom do not disclose or suggest an ignition material for an electrically actuatable igniter that deflagrates when heated to a temperature of at least about 250°C and that includes a metal powder, which is selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder, and an oxidizer, which has an average particle size of about .1 μm to about 30 μm; and (2) it would not have been obvious to use the electro-exploded particles taught in Wheatley in the ignition compositions of Baginski or Halcomb et al. Therefore, claim 44 is allowable for the same reasons as claim 42 and for the specific limitations recited in claim 44.

In view of the foregoing, it is respectfully submitted that the above-identified application is in condition for allowance, and allowance of the above-identified application is respectfully requested.

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Attached hereto is a marked-up version of the changes made to the claims by the present amendment. The attached page is captioned "**AMENDED CLAIMS WITH MARKINGS**."

Please charge any deficiency or credit any overpayment in the fees for this amendment to Deposit Account No. 20-0090.

Respectfully submitted,

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Amended Claims With Markings

Claim 33 has been amended as follows:

33. (Amended) An electrically actuatable igniter comprising:

a pair of electrodes;

a heating element electrically connected between said electrodes; and

an ignition material in contact with said heating element, said ignition material comprising a mixture of a metal powder and a particulate oxidizer that exothermically reacts with said metal powder, ~~said metal powder including macro-agglomerates of metal particles, said metal particles having an average diameter less than about 0.1 μm and having an oxide layer that prevents contact of said particles with said oxidizer,~~ said oxidizer having an average particle size of about 1 μm to about 30 μm, said metal powder being selected from the group consisting of electro-exploded aluminum powder, electro-exploded titanium powder, electro-exploded copper powder, electro-exploded zinc powder, and electro-exploded yttrium powder, wherein said ignition material deflagrates when the heating element is heated to a temperature of at least about 250°C.

Claim 42 has been amended as follows:

42. (Amended) An electrically actuatable igniter comprising:

a pair of electrodes;

a heating element electrically connected between said electrodes; and

an ignition material in contact with said heating element, said ignition material comprising about 25% to about 50%, by weight of the ignition material, a metal powder and a particulate oxidizer that exothermically reacts with said metal powder, ~~said metal powder including macro-agglomerates of metal particles, said metal particles having an average diameter less than about 0.1 μm and having an oxide layer that prevents contact of said particles with said oxidizer,~~ said oxidizer having an average particle size of about 1 μm to about 30 μm, wherein said metal powder consists of electro-exploded aluminum powder and said ignition material deflagrates when the heating element is heated to a temperature of at least about 250°C.